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A PROPOSAL For INCREASING the STRENGTH OF THE *BRITISH* NAVY,

By Changing all the Guns, from the Eighteen Pounders downwards, into Others of Equal Weight but of a Greater Bore.

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W. Mulgrave.

BRITISH MUSEUM

PREFACE.

THE following Paper was drawn up near two Years ſince; in Conſequence of ſome Experiments and Speculations of a much older Date. As it is cuſtomary for Mankind to ſuppoſe no one ſkilful in any Profeſſion, in which he has not been regularly initiated, and to which he is not formally attached; I did not expect, that this Production, were it made publick, would be conſidered otherwiſe than as the viſionary Notions of a Speculatiſt, utterly unacquainted with the Subject he had undertaken to diſcuſs. Nor would it have been poſſible for me to have removed this Prejudice by the moſt authentic Proofs, I could have given, of my Attention and Induſtry in trying the various Concluſions, on which the enſuing Suggeſtions are founded.

But having lately been favoured, by the Honourable *George Anſon*, Eſq; Vice-Admiral of the *Blue*, and One of the Lords of the Admiralty, with the Peruſal of a *French* Manuſcript, taken on board the *Mars* Man of War, I therein found recited a great Number of Experiments, extremely appoſite to the Principles inculcated in the enſuing Paper; beſides ſeveral important Confirmations of a late Reform in the Service of the *French* Artillery, analogous to what I have propoſed. And therefore, as the Authority of theſe *French* Papers will, I hope, alleviate at leaſt the Cenſures I might be otherwiſe expoſed to; and as the Particulars, they contain, are not, I think, unworthy publick Knowledge; I have, on this Account, ventured to publiſh the following Tract; and have annexed thereto, by Way of Annotation, ſuch Articles of this *French* Manuſcript, as, I conceived, would fully confirm the Poſitions I had advanced, and would thereby render the Matter, I have treated of, more worthy of future Conſideration; reſerving till another Time a more ample Account of all theſe *French* Experiments, and the various Deductions founded thereon.

A PROPOSAL For INCREASING the STRENGTH OF THE *BRITISH* NAVY, &c.

THE Advantage of large Cannon over thoſe of a ſmaller Bore is ſo generally acknowledged, that a particular Diſcuſſion of it might perhaps be ſpared: But, as it may

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be neceſſary to recur to the Principles, on which this Advantage is founded, in obviating ſome Objections, which may perhaps be made to the preſent Propoſal; the Author begs Leave to enumerate the particular Circumſtances, in which heavy Shot excel, together with the Reaſons of this Superiority; and this, from the great Number of Experiments he has made on theſe Subjects, he flatters himſelf, he is better able to do, than could be done by any one from the inaccurate Obſervations of common Practice only.

And firſt in diſtant Cannonading: The Reſiſtance of the Air to Cannon-Bullets, when they are fired with their uſual Allotment of Powder, is ſo extremely great, that the Diſtance, they range to at an Elevation, is more regulated by the Degree of this Reſiſtance, than by the Velocity they receive from the Powder. And the larger Bullets being leſs reſiſted in Proportion to their Weight than the ſmaller, the Diſtance, to which theſe larger Bullets fly with the ſame Proportion of Powder, exceeds the Flight of the ſmaller ones, almoſt in the Proportion of their Diameters; ſo that a Thirty-two Pound Shot, for Inſtance, being ſomewhat more than ſix Inches in Diameter, and a Nine Pound but four Inches; the Thirty-two Pound Shot will fly near half as far again as that of Nine Pound, if both Pieces are ſo elevated as to range to the furtheſt Diſtance poſſible.

And this Advantage in the Range of the heavier Bullet is not eaſily to be counter-balanced by any extraordinary Effort given to the ſmaller Bullet, by increaſing the Quantity of its Powder; for though the Swiftneſs of the ſmaller Bullet, at its iſſuing from the Piece, may be thereby greatly increaſed, yet, as has been already obſerved, the Diſtance, to which the Bullet flies at an Elevation, is thereby but little influenced; for all this Increaſe of the Celerity is preſently taken away by the Reſiſtance of the Air, which increaſes much faſter. Thus, for Inſtance, though a Bullet fired with two Thirds of its Weight in Powder has doubtleſs a greater Velocity than the ſame Bullet when fired with only one Third of its Weight in Powder, yet if their Ranges at ten or fifteen Degrees are compared together, the certain Difference between them will not be worth regarding; for it will not be more than the Irregularities, which happen in Repetitions of the ſame Trial with the ſame Piece, Charge, and Elevation [a].

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[a] This Aſſertion, however ſtrange it may appear at firſt Sight, is irrefragably eſtabliſhed by the Experiments recited in the *French* Manuſcript mentioned in the Preface. For there it appears, that when a Twenty-four Pounder was elevated to five Degrees, and loaded ſucceſſively with eight, nine, ten, eleven, twelve, fourteen, ſixteen,

But this Circumſtance of ranging farther in diſtant Cannonading is perhaps the leaſt inconſiderable Pre-eminence of heavy Shot; for the Uncertainty in this Practice, eſpecially at Sea, is ſo great, that it has been generally diſcountenanced by the moſt ſkilful Commanders, as tending only to waſte Ammunition.

ſixteen, eighteen, and twenty Pounds of Powder, the Medium Range with eight Pounds of Powder was eight hundred and forty Toiſes, and the Medium Range with twenty Pounds of Powder was but nine hundred and ſeventy. Now the Difference between eight hundred and forty, and nine hundred and ſeventy, is not ſo great as the Difference which ſometimes occurred in theſe Trials, on the Repetition of the ſame Experiment. I ſhall only add, that both the Quantity and Proportion of the Ranges with eight, and with twenty Pounds of Powder, are extremely near what I have long ſince computed them at, and that the whole of theſe Experiments are entirely conſiſtent with the Theory both of the Force of Powder, and of the Reſiſtance of the Air which I have ſometime ſince eſtabliſhed.

The moſt important Advantage of heavy Bullets is this, that, with the ſame Velocity, they break out Holes in all ſolid Bodies in a greater Proportion than their Weight; that is, for Inſtance a Twenty-four Pound Shot will, with the ſame Velocity, break out a Hole in any Wall, Rampart, or ſolid Beam, in which it lodges, above eight Times larger than will be made by a Three Pound Shot; for its Diameter being double, it will make a ſuperficial Fracture above four Times as great as the Three Pounder (more of a ſmaller Hole being cloſed up by the ſpringing of the ſolid Body than of a great one) and it will penetrate to more than twice the Depth. By this Means the firmeſt Walls of Maſonry are eaſily cut through their whole Subſtance by heavy Shot, which could never be effected by thoſe of a ſmaller Calibre; and in Ships the ſtrongeſt Beams and Maſts are hereby fractured, which a very great Number of ſmall Bullets would ſcarcely injure.

To this laſt Advantage of large Cannon, which is indeed a capital one, there muſt be added that of carrying the Weight of their Bullet in Grape or Lead Shot, and thereby annoying the Enemy more effectually than could be done by ten Times the Number of ſmall Pieces.

Theſe are the principal Advantages of large Cannon, and hence it is no Wonder, that thoſe entruſted with the Care of the *Britiſh* Navy have always endeavoured to arm all Veſſels with the largeſt Cannon, they could with Safety bear; and, indeed, within theſe laſt hundred Years, great Improvements have been made on this Head, by reducing the Weight of many of the Species's of Cannon, and thereby enabling the ſame Ships to carry

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Guns of a larger Bore; and very lately the Six Pounders in ſome of the ſmaller Ships have been changed for Nine Pounders of a lighter Fabrick than uſual, which hath been juſtly eſteemed a very great Addition to the Strength of thoſe Veſſels.

The Importance then of allotting to all Ships the largeſt Cannon they can with Safety bear, being granted; it remains to ſhew, on what Foundation a Change is propoſed to be made in the Fabrick of all Pieces from the Twenty-four Pounders downwards; whereby all the Guns from the preſent Eighteen Pounders downwards, may be changed for others of the ſame or leſs Weight, but of a larger Bore. This Propoſition turns on the following Conſiderations.

The Species of Cannon proper for each Ship is limited by the Weight of the Pieces, and when the Charge and the Effort of the Bullet are aſſigned, this Weight in each Species is or ought to be determined by the following Circumſtances:

That they ſhall not be in Danger of burſting.

That they ſhall not heat too much in frequent firing.

And that they ſhall not recoil too boiſterouſly.

All this is to be done by a proper Quantity of Metal properly diſpoſed; and when the Pieces are ſecured from theſe Accidents, all Addition of Metal beyond is not only uſeleſs but prejudicial.

Now what Dimenſions and Weight of Metal are more than ſufficient for this Purpoſe, we may learn from the preſent Practice of the Navy in the Fabrick of the Thirty-two Pounders, the heavieſt Guns in common Uſe; theſe are made to weigh, if the Author's Information be right, from Fifty-two to Fifty-three Hundred Weight; that is, ſomewhat leſs than an Hundred and two Thirds for each Pound of Bullet.

From this then the Author concludes, that any ſmaller Piece, made upon the Model of theſe Thirty-two Pounders, and having their Weight proportioned in the ſame Manner to the Weight of their Bullet, will fully anſwer all the Purpoſes recited above, and will be of unexceptionable Service.

And he founds his Opinion on theſe two Principles:

Firſt, That the Strength of Iron, or of any other Metal, is in Proportion to its Subſtance;

ſtance; ſo that, for Inſtance, where it has half the Subſtance, it has half the Strength; and this Suppoſition, he preſumes, will be ſcarcely conteſted.

Secondly, That the Force of different Quantities of Powder fired in Spaces, which they reſpectively fill, is not exactly in the Proportion of thoſe Quantities, but the leſſer Quantity has in Proportion the leaſt Force; that is, for Inſtance, the Force of one Pound of Powder, in like Circumſtances, is leſs than half the Force of two Pounds: And this Principle the Author has deduced from many repeated and diverſified Trials of his own; and he believes, it will be found agreeable to all the Obſervations, which have been made, or ſhall be made on this Subject.

From theſe two Conſiderations, he hopes, it will be granted him, That if two Pieces, a large one and a ſmall one, are made with all their Dimenſions in Proportion to the Diameter of their reſpective Bullets, and conſequently their Weights in the ſame Proportion with the Weights of their Bullets, then the larger Piece, with the ſame Proportion of Powder, will be more ſtrained, will heat more, and recoil more than the ſmaller.

Hence then, as we are aſſured, that the preſent Thirty-two Pounders are of a ſufficient Strength and Weight for all Marine Purpoſes; we have the greateſt Reaſon to ſuppoſe, that if all the Pieces of an inferior Calibre were formed upon the ſame Model, meaſuring by the Diameter of the Bullet, theſe ſmaller Pieces would not be defective in either Strength or Weight, but would be to the full as ſerviceable on Ship-board as the preſent Pieces, which are ſo much overloaded with Metal.

The Author's Scheme then for augmenting the Force of the preſent Sea-Batteries, is no more than this plain Principle, That all Ship-Guns ſhould be caſt upon the Model of the Thirty-two Pounders, meaſuring by the Diameter of the reſpective Bullet; ſo that for each Pound of Bullet there ſhould be allowed one Hundred and two Thirds of Metal only.

The Advantages of this Scheme will appear, by the following Compariſon of the Weight of the preſent Pieces, with their Weight propoſed by this new Fabrick.

Pieces.	Weight now in Hund.	Ditto by new Fabric.
24	48 to 46	40
18	41 to 39	30
12	34 to 31	20
9	29 to 26	15
6	24 to 18	10

Hence then it appears, That the Twenty-four Pounders will be eaſed of ſix or eight Hundred of uſeleſs Metal; and that, inſtead of thoſe of an inferior Calibre now uſed, much larger ones of the ſame Weight may be born, eſpecially when it is remembered, that this Computation exceeds even the preſent Proportion of the Thirty-two Pounders; ſo that from the above projected Eighteen Pounders, for Inſtance, two or three Hundred may be ſafely taken.

The Changes then propoſed by the Author are theſe:

	Pounders.		Hundreds.		Pounders.		Hund.
For	6	of	24 and 18,	New	12	of	20
	9		29 and 26,		18		28
	12		34 and 31,		18		28
	18		41 and 39,		24		40

The Nine Pounders lately caſt being, as the Author is informed, ſtill lighter than what is here repreſented, they may perhaps be only transformed into Twelve Pounders; but this will be a very great Addition of Strength, and the Twelve Pounders thus born will be conſiderably lighter than the ſmalleſt Nine Pounders now in Uſe.

That many Objections will be made to the preſent Propoſal, is not to be queſtioned; but as they will equally hold againſt the Uſe of the preſent Thirty-two Pounders, which are known to be Guns of unexceptionable Service, that alone, it is conceived, will be an Anſwer.

If it be ſuppoſed (as ancient Practice is always favourably heard) that the Exceſſes in the proportionate Weight of the ſmall Pieces muſt have been originally founded on ſome approved Principle, or otherwiſe they could not have been brought into Uſe: It may be anſwered, that an hundred Years ſince there were Four Pounders made uſe of, which were heavier than ſome of the preſent Nine Pounders, and had the ſame Preſcription to plead in their Behalf. Perhaps the Origin of this Exceſs in the ſmaller Pieces may be accounted for by ſuppoſing, that when Guns are uſed in Batteries on Shore, their Length cannot be in Proportion to the Diameter of their Bore, becauſe the Parapet being of a conſiderable Thickneſs, a ſhort Piece would by its Blaſt ruin the Embraſures; and the ſmaller Pieces, being for this Reaſon made nearly of the ſame Length with the larger, did hence receive their additional Weight of Metal. But this Reaſon holds not at Sea, where there is no other Exception to the Shortneſs of a Piece, but the Loſs of Force, which, in the Inſtances here propoſed, is altogether inconſiderable. For the old Twelve Pounders, for Example, being in Length from nine Feet to nine and a half, the new ones here propoſed will be from ſeven Feet to ſeven and a half long. The Difference in the Force of the Bullet, fired from theſe different Pieces, is but little; and it will hereafter appear, that in the preſent Subject much greater Differences than theſe are of no Conſequence.

If it ſhould be ſaid, that the new Fabric here propoſed muſt have the preſent Allowance of Powder (which in the ſmaller Pieces is half the Weight of the Ball) diminiſhed, and that it muſt be reduced to the Rate of the Thirty-two Pounders, which is only ſeven Sixteenths of the Weight of the Ball; it is anſwered, that if the Powder, in all Ship-Cannon whatever, was ſtill farther reduced to one Third of the Weight of the Ball, or even leſs, it would be a conſiderable Advantage, not only by the ſaving of Ammunition, but by keeping the Guns cooler and quieter, and at the ſame Time more effectually injuring the Veſſels of the Enemy [b]; for with the preſent

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[b] The Change propoſed here, of reducing the Quantity of Powder in all Ship-Guns to one Third of the Weight of the Bullet, has for ſome Time paſt been practiſed by the *French* in a much ſeverer Service, where the increaſing the Velocity of the Bullet could not at any Time diminiſh its Effect; the Service, I mean, is battering in Breach. For I learn from the forementioned *French* Manuſcript, that of late Years all their Breaches, in the different Sieges they have undertaken, have been made with this very Charge, that is, their Twenty-four Pounders have been loaded with eight Pounds of Powder, and they have found, that though the Penetration of the Bullet is leſs with this Charge than with a larger one, yet the other Conveniencies, attending this ſmaller Charge, are more than ſufficient to balance that Particular.

And here I muſt obſerve, that there have not been wanting Perſons of conſiderable Name, who have aſſerted (as appears from the Manuſcript in Queſtion) that the Velocity of a Twenty-four Pound Bullet was really greater with eight Pounds of Powder than with any larger Quantity; founding their Opinion on the ridiculous Perſuaſion, ſent Allowance of Powder the Guns are heated, and their Tackle and Furniture ſtrained, and this only to render the Bullet leſs efficacious, than it would prove if impelled by a ſmaller Charge. Indeed in battering of Walls, which are not to be penetrated by a ſingle Shot from any Piece whatever, the Velocity of the Bullet, how much ſoever augmented, ſtill produces a proportionable Effect, by augmenting the Depth to which it penetrates: But the Sides of the ſtrongeſt Ship, and the greater Part of her Timbers, are of a limited Thickneſs, inſufficient to ſtop the Generality of Cannon Bullets, fired at a reaſonable Diſtance, even with a leſs Charge than is here propoſed.

ſuaſion, that whatever Quantity was put in, no more than eight Pounds of it took fire. But this Poſition is deſtroyed by their own Experiments and their own Reaſonings; and later Experiments, made with greater Attention, put it beyond all Doubt, that to the larger Charge (at leaſt as far as twenty Pounds of Powder) there correſponds a greater Velocity.

And it is Matter of Experiment, that a Bullet, which can but juſt paſs through a Piece of Timber, and loſes almoſt all its Motion thereby, has a much better Chance of rending and fracturing it, than if it paſſed through it with a much greater Velocity.

That a better Judgment may be made of the Reaſonableneſs of this Speculation, the Author thinks proper to add (and he believes future Experience will not contradict him) that a Twelve Pounder, as here propoſed, which is one of the ſmalleſt Pieces at preſent under Conſideration, when charged with one Third of the Weight of the Bullet in Powder, will penetrate a Beam of the beſt ſeaſoned, tougheſt Oak to more than twenty Inches Depth; and if, inſtead of one ſolid Beam, there are a Number of ſmall ones, or of Planks laid together; then allowing for the rending and tearing, frequent in ſuch Caſes, he doubts not, but it will often go through near double that Thickneſs, and this any where within a hundred Yards Diſtance; that is, any where within that Diſtance which the moſt experienced Officers have recommended for naval Engagements. In the ſame Diſtance, a Bullet from the Twelve Pounders now in Uſe, charged with half the Weight of Powder, will penetrate about one Third Part deeper: But if the Efforts of each Piece are compared together at five hundred Yards Diſtance, the Differences of their Forces will not be conſiderable: If this be ſo, it will not be aſſerted, I imagine, that the Twelve Pounder here propoſed is leſs uſeful, or leſs efficacious, for all naval Purpoſes, than the weightier Twelve Pounder hitherto made Uſe of.

The Author has in this Propoſal fixed on the Thirty-two Pounders as the Standard for the reſt, becauſe they have been authoriſed by long Experience: But from the Trials he has made, he is well ſatisfied, a much greater

Reduction of Weight, than he here propoſes, might ſafely take place; and that one Fourth, or even one Fifth, of the Weight of the Bullet in Powder, if properly diſpoſed, is abundantly ſufficient for every Species of Ship-Guns[c].

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[c] This Opinion is not advanced at Random. I have myſelf procured to be caſt a Four Pounder of Iron, weighing about two Hundred Weight, which is not one Third of the Weight here propoſed: As likewiſe two others, one of about three Hundred Weight, and the other about four Hundred. That of three Hundred Weight, being fired with twelve Ounces of common Powder, went through, at the ſame Time, two Planks of very ſound Oak of four Inches thick each, and a Beam of the ſame fourteen Inches thick, being in all twenty-two Inches, and afterwards buried itſelf in a Bank of Earth. And this it likewiſe did on a ſecond Repetition, when it broke off a Piece of the Beam of a Quarter of an Hundred Weight, and drove it to above ten Yards Diſtance. The firſt and ſecond of theſe Pieces on repeated Trials burſt, but the laſt of four Hundred Weight continues ſtill entire, and is, I conceive, as ſerviceable a Field-Piece as any whatever, notwithſtanding its Lightneſs. For with nine Ounces of Powder it

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However the Author is far from deſiring, that his Speculations ſhould be relied on in an Affair of this Nature, where he pretends not to have tried the very Matter he propoſes, but founds his Opinion on certain general Principles and collateral Experiments, which, he conceives, he may apply to the preſent Caſe without Error. He would himſelf recommend an experimental Examination of this Propoſal, as the only one to which Credit ought to be given. What he intends by the preſent Paper, is to repreſent it as a Matter

throws its Bullet point blank, as it is called, three hundred Yards. And it will bear proving with twice or three Times its proper Charge. Indeed the other two, which were lighter, did not fail, I conceive, from a Want of ſufficient Subſtance, but from a particular Miſtake in their Fabric. However, the heavieſt of them is but about one Quarter of the Weight, they are generally made of; and conſequently, if capable of proper Service, might in particular Emergencies be of infinite Uſe.

worthy of Conſideration, and really ſuch as it appeared to him. If thoſe, to whoſe Cenſure he ſubmits it, are of the ſame Opinion, there is an obvious Method of determining, how far his Allegations are concluſive; and that is, by directing one of theſe Pieces to be caſt, a Twelve Pounder for Inſtance, and letting it be proved with the ſame Proportion of Powder, allotted for the Proof of the Thirty-two Pounders. Then if this Piece be fired a Number of Times ſucceſſively on a Carriage, and its Recoil and Degree of Heat be attended to, and if the Penetration of its Bullet into a thick Butt of Oak Beams or Plank be likewiſe examined, a Judgment may thence be formed of what may be expected from the Piece in real Service; and the Reſult of theſe Trials will be the moſt inconteſtable Confutation, or Confirmation of this Propoſal.

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